

Intermediate Algebra

Prerequisite: Mastery of Geometry or Applied Mathematics II

Course Description

Intermediate Algebra will build upon the knowledge previously learned in Elementary Algebra and Geometry. It will provide students with the reasoning skills necessary for many careers and the mathematical tools they will need to be successful in advanced mathematics classes.

The study of functions is the primary focus of Intermediate Algebra. Exploring functions, investigating their behaviors, and making and verifying reasonable conjectures about those behaviors will help develop students' reasoning and thinking skills. To develop these important skills, students will study functions, algebraically by traditional methods, as well as numerically and graphically using technology and manipulatives. Types of functions receiving a major focus in the course will be quadratic, absolute value, radical, and sine and cosine. The course will also emphasize the concepts of complex numbers, matrices, systems of equations and inequalities, and probability using permutations and combinations. While mathematical skills will be developed, teaching will focus on understanding of concepts in depth, enabling students to apply mathematical skills and make meaningful connections to life experiences.

Students will need a graphing calculator for this course, and it is recommended that they obtain a calculator that they may use for the A.P. Calculus, A.P. Statistics, and ACT tests.

Intermediate Algebra

Standard 1: Students will acquire number sense and perform operations with real and complex numbers.

Objective 1.1: Compute fluently and make reasonable estimates.

- a. Simplify numerical expressions including those with rational exponents, e.g.,
 $27^{2/3} = (3^3)^{2/3} = 3^2 = 9$
- b. Add, subtract, multiply, and divide complex numbers.
- c. Add, subtract, and multiply (including scalar multiplication) matrices using paper and pencil for simple cases and technology for more complicated cases.
- d. Find the multiplicative inverse of a matrix using paper and pencil for a 2 x 2 and technology for larger matrices.

Objective 1.2: Represent complex numbers in a variety of ways.

- a. Identify the need for the square root of a negative number and define the imaginary number
 $i = \sqrt{-1}$.
- b. Extend the number system to include complex numbers in the form $a + bi$.
- c. Simplify expressions involving square roots of negative numbers and powers of i .

Objective 1.3: Identify relationships among real numbers and operations involving these numbers.

- a. Identify matrices that can be added, subtracted, or multiplied.
- b. Demonstrate that matrix multiplication is not commutative.
- c. Identify additive and multiplicative identities and inverses of a matrix when they exist.

Standard 2: Students will represent and analyze mathematical situations and properties using patterns, relations, functions, and algebraic symbols.

Objective 2.1: Use patterns, relations, and functions to represent mathematical situations.

- a. Determine when a relation is a function.
- b. Use function notation.
- c. Compose two functions.
- d. Add, subtract, and multiply functions.
- e. Find the inverse of a function by interchanging the values of domain and range, reflecting across the line $y = x$, or using algebra.
- f. Define the cosecant, secant, and cotangent as reciprocals of sine, cosine, and tangent.

Objective 2.2: Evaluate, solve, and analyze mathematical situations using algebraic properties and symbols.

- a. Solve quadratic equations of a single variable.
- b. Solve first-degree absolute value equations of a single variable.
- c. Solve radical equations of a single variable including those with extraneous roots.
- d. Solve quadratic and absolute value inequalities of a single variable.
- e. Write a quadratic equation when given the solutions of the equation.
- f. Given a system of linear equations, write a matrix equation representing the given system.
- g. Use the properties of matrices to solve systems of linear equations with up to three variables. e.g., augmented matrices, matrix equations, Cramer's rule.
- h. Graph the solution to systems of linear inequalities.
- i. Add, subtract, multiply, and divide rational expressions and solve rational equations.
- j. Recognize that a^{-n} is defined as the reciprocal of a^n and use this knowledge to simplify expressions, i.e.,

$$a^{-n} = \frac{1}{a^n} \text{ if } a \neq 0.$$
- k. Recognize that rational exponents are used to represent radicals and use this knowledge to simplify

Objective 2.3: Represent quantitative relationships using mathematical models and symbols.

- a. Find and interpret rates of change by analyzing graphical and numerical data for quadratic and radical functions.
- b. Find the vertex, maximum or minimum values, intercepts, and axis of symmetry of a quadratic or absolute value function algebraically, graphically, and numerically.
- c. Using the method of completing the squares, compare parabolas and circles with their parent graphs by writing parabolas in the form $y = a(x - h)^2 + k$ and circles in the form $(x - h)^2 + (y - k)^2 = r^2$.

	<p>expressions, i.e., $a^{\frac{p}{q}} = \sqrt[q]{a^p} = (\sqrt[q]{a})^p$ if $a > 0$</p> <p>l. Represent intervals with correct symbolic notation; e.g., $a < x < b$, (a, b), $[a, b]$.</p>	
Standard 3: Students will solve problems using spatial and logical reasoning, applications of geometric principles, and modeling.		
	<p>Objective 3.2: Specify locations and describe spatial relationships using coordinate geometry.</p> <ol style="list-style-type: none"> Identify the domain and range of the absolute value, quadratic, radical, sine, and cosine functions. Graph quadratic functions. Graph absolute value functions. Graph the solutions of absolute value and quadratic inequalities of a single variable on a number line. Graph the solutions of absolute value and quadratic inequalities of two variables Graph a square root function. Graph sine and cosine functions. Write an equation of a parabola in the form $y = a(x - h)^2 + k$ when given a graph. Perform the transformations of stretching, shifting, and reflecting the graphs of linear, absolute value, quadratic, and radical functions. Perform transformations of stretching (amplitude and period), shifting (phase shift or horizontal shift) and reflecting on the sine and cosine functions. 	<p>Objective 3.3: Solve problems using visualization, spatial reasoning, and geometric modeling.</p> <ol style="list-style-type: none"> Solve application problems involving absolute value and quadratic functions. Solve application problems using graphs of sine and cosine functions.
Standard 4: Students will understand and apply measurement tools, formulas, and techniques.		
<p>Objective 4.1: Understand measurable attributes of objects and the units, systems, and processes of measurement.</p> <ol style="list-style-type: none"> Convert angle measurements between radians and degrees. Express angle measure in degrees or radians when given the trigonometric value. Calculate the exact values of the sine, cosine, and tangent functions for the special angles of the unit circle using reference angles. 	<p>Objective 4.2: Determine measurements using appropriate techniques, tools, and formulas.</p> <ol style="list-style-type: none"> Find the length of an arc using radian measure. Find the area of a sector in a circle using radian measure. 	

Standard 5: Students will draw conclusions using concepts of probability after collecting, organizing, and analyzing a data set.		
<p>Objective 5.1: Formulate and answer questions by collecting, organizing, and analyzing data.</p> <ul style="list-style-type: none"> a. Determine the quadratic regression equation for a given set of bivariate data using technology. b. Analyze the meaning of the maximum or minimum and intercepts of the regression equation as they relate to a given set of bivariate data. c. Make predictions and estimations and determine their reasonableness using a regression equation. 	<p>Objective 5.2: Apply basic concepts of probability.</p> <ul style="list-style-type: none"> a. Distinguish between a permutation and a combination. b. Calculate simple combinations and permutations of n objects taken r at a time. c. Calculate a probability using the Fundamental Counting Principle. 	